Public Health Investigation
Chemical Contaminants From Industrial Manufacturing in Air and Water Affecting Residents In Crossett, Arkansas

Preliminary Report and Laboratory Analysis 2012

Prepared for:

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Executive Summary

The purpose of our investigation was to perform a preliminary assessment of air and water in search of contaminates which may pose a threat to public health.

Contamination of the air we breathe, our land and drinking water by industrial activity continues to go virtually unnoticed and unchallenged, often to the detriment of public health. Exposure to fumes, gases, dust, metals, metalloids, pesticides and chemicals from manufacturing can cause serious health consequences. Chemicals and other pollutants are carried in the air or by run-off and deliberate discharges into, springs, rivers, lakes and ponds. Contaminants can also travel great distances underground polluting aquifers which supply public and private drinking water.

Crossett, Arkansas is no exception. It is home to Georgia Pacific, one of the largest paper mills and chemical manufacturing plants in the nation. The plant discharges some 45 million gallons per day (MGD) of toxic waste water, which finds its way from Coffee Creek, through Mossy Lake to the Ouachita River. Noxious and nauseous odors in both the water and air pervade, persist and plague community residents.

The city of Crossett has a high incidence health related issues which include: cancers, asthma, COPD, learning disabilities and other disease. These may be potentially attributed to hazardous chemical exposure from plant discharges. Tainted public drinking water drawn from an industrially polluted aquifer is used for drinking, cooking and bathing. Discharges of toxic hazardous chemicals to the air, complete all three routes of exposure for human poisoning.

Conclusion

We found significant quantities of hydrogen sulfide gas, in Crossett neighborhoods during our investigation. The gas emanates from the Georgia Pacific industrial complex and affects the residents quality of life. Nauseating odors are often worse at night and especially during periods of thermal inversions. The gas we found can be very dangerous to human health and to knowingly subject a population to its effects is unconscionable. Residents have no escape and are forced to endure daily chemical

assaults. The gas is also destructive of personal property, corroding air conditioners and other exposed metal. Due to the multiple chemical processes and products produced by this facility, we recommend further investigation into other possible airborne contaminants including formaldehyde, dioxins and other hazardous chemicals.

Hydrogen sulfide can induce DNA damage by concentrations as low as 1 mmol/L in air. We found levels as high as 25 ppb. Levels that can cause harm.

We sampled ground water and drinking water from both private wells and public drinking water from kitchen taps. All water samples that we analyzed were contaminated with industrial organic chemicals. We also found metals and metalloids which included arsenic, cadmium and high levels of zinc.

We found *hazardous industrial chemicals* in the city's drinking water being supplied to residents and businesses and list them below. We strongly urge further investigation into the extent of aquifer contamination. There is a strong possibility of finding additional chemical contaminants, other than those listed in this report, which may have also polluted the aquifer. We suggest other communities drawing water from this aquifer may also be affected. This will require further investigative action.

Hazardous Organic Chemicals and Metal Contaminants in Crossett's Tap Water

Acetone
Benzene
Bromoform
Dibromochloromethane
Diethyl Phthalate
Phenol
Tertiary Butylmethyl ether (MTBE)
Zinc

Approximately 60 other hazardous organic chemicals, metals and metalloids were identified in low background concentrations. These chemicals could appear in higher more observable concentrations at any time depending on flow within the groundwater

and aquifer. Further investigation of these chemicals and the extent of aquifer contamination is warranted.

Continuous plant discharges, leaking tanks, damaged seals on chemical plant pumps, spills, washing of tank trucks and rail cars, are all potential sources for hazardous chemical contamination. These materials percolate to ground water and contaminate drinking water aquifers. Hazardous chemical discharges not only create environmental stress, they are also origins for human exposure and illness.

Recommendations

The public is advised not to drink or cook with this water without adequate treatment, as the chemicals found are a hazard to health and can cause harm and illness, some of which could be permanently debilitating. These chemicals can also be absorbed through the skin, so whole house filtration or an alternate water source is advised.

Advanced water treatment equipment, which includes organic carbon filtration, reverse osmosis and other safety measures, is recommended for all homes and buildings for absorption of these hazardous industrial organic chemicals as well as continuous monitoring and testing.

The Sampling Program

During 2012 we implemented a sampling program to assess possible human exposure to hazardous industrial chemical contaminants. Due to financial constraints, we were limited in the number of analysis performed. Only chemical candidates most likely to be found were initially selected. We sampled the air in Crossett neighborhoods for hydrogen sulfide. We also sampled and analyzed water for contaminants from the plant wastewater stream discharge, groundwater using private wells and city supplied potable tap water drawn from the aquifer. We also found toxic chemical laden black tarry deposits (photo page10) along the banks throughout the discharge area. Laboratory analysis of the black deposits taken by Barry Sulkin are shown on page 6.

Aerial reconnaissance of the area by Cheryl Slavant, shows massive areas of disturbed and contaminated soils and of damaged and dead plant life, an ecosystem destroyed by years of chemical contamination. During 2012 a large section of the GP property was excavated and stripped and thousands of yards of potentially toxic soils were removed. We could not find permits or documentation for the removal of contaminated soils. We believe permits should have been required as these soils likely contained deadly dioxins and other hazardous chemicals. Photos on page 11

An ecological study of the area done in 2007 by Parsons and the University of Arkansas, Ecological Engineering Group, for the EPA Region 6, shows directional flow of treated wastewater from the plant.(1) According to Culp and Culp, plant upgrades in the 1960s, increased flow capacity from 30 to 45 MGD and remains unchanged. (2)

Today, 45 MGD of contaminated water pass through Georgia Pacific clarifiers and is discharged to a settling basin which then enters Coffee Creek. The water flows SW 1.5 miles to a 625 million gallon, on-channel aeration lagoon also known as the Mill Pond. Discharge from the lagoon is known as Outfall 001 Coffee Creek which flows to Mossy Lake. Coffee Creek has a watershed area of approximately 25 square miles and Mossy Lake an area of some 550 acres which flows into the Ouachita River. It is along this route, from plant manufacturing operations through to the Ouachita River that chemicals contaminate the ground water and aquifer. The location of Outfall 001 is Latitude: 33 " 06' 22.55"; Longitude: 92" 02' 17.2" shown on page 8 and displays the area from Mill Pond to the Ouachita River. (3) Photographs on page 7 show outfall #1.

Environmental Science Corp.
Laboratory Services

SEMI-VOLATILES ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Client Name: Barry Sulkin

Project Desc. Coffee Creek

Client ID: BLACK SOLID BELOW L

Matrix: SOIL

ESC Sample No: L517290-01

Date Collected: 4/27/2011

Lab File ID: 0527_18

Date Analyzed: 5/27/2011

Dilution Factor: 4,800.00

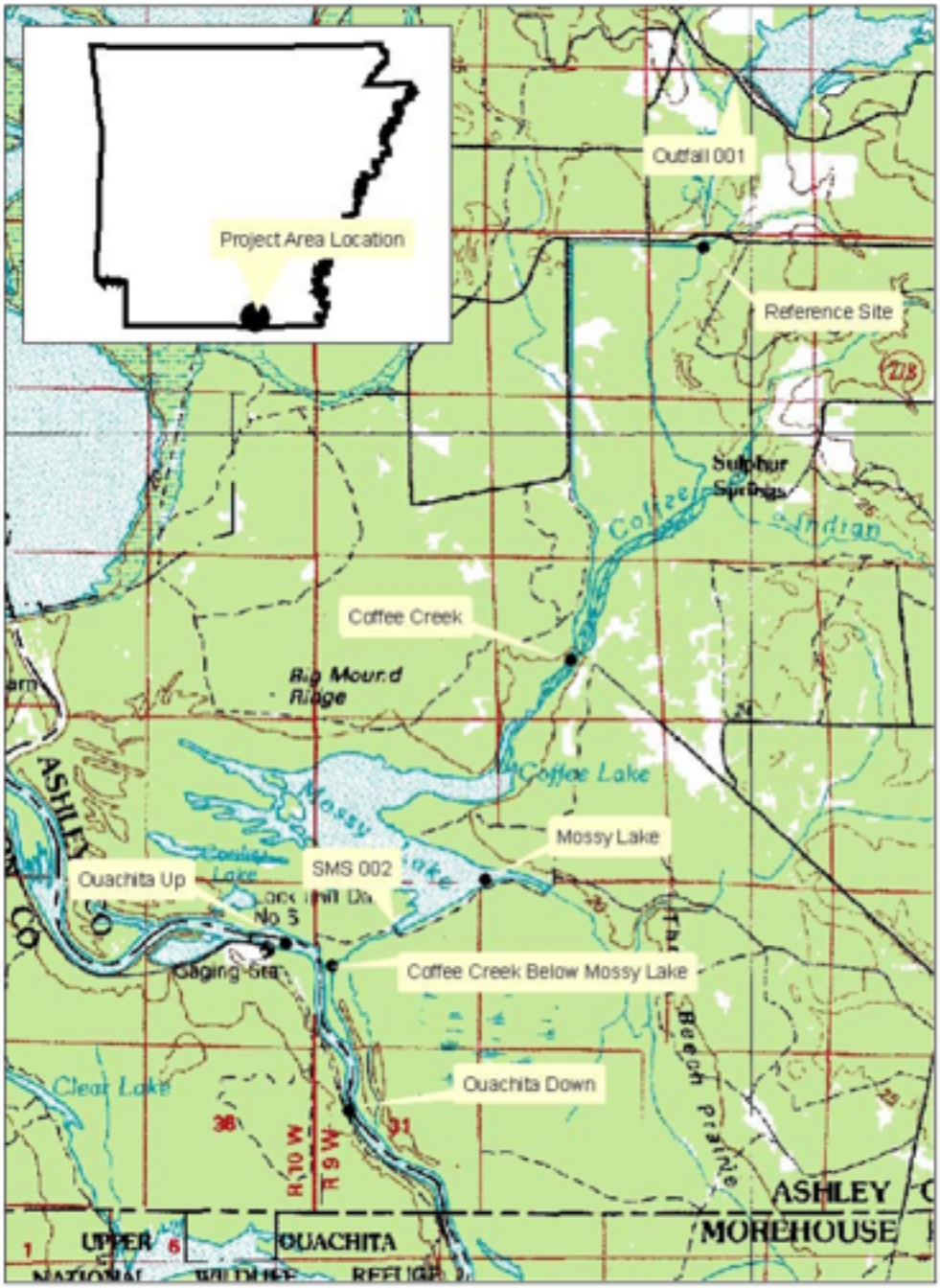
Tentatively Identified compounds (TIC) refers to substances not present in the list of target compounds. Therefore, not all TIC's are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search routine of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist. Quantitation is accomplished by relative peak area of the TIC compared to that of the nearest internal standard from the total ion chromatogram. TIC's are identified and quantitated only if the peak area is 10% or more of that of the nearest internal standard.

Number of TICs Found: 10

Concentration units: mg/kg

CAS NO.	COMPOUND	RT	EST. CONC.	QF	QA
000057-10-3	Hexadecanoic acid	7.57	412	95.00	J
002442-49-1	Tetracosanoic acid, methyl ester	9.49	1,220	94.00	J
000057-11-4	Octadecanoic acid	9.65	856	93.00	J
006627-88-9	Phenol, 2,6-dimethoxy-4-(2-propeny	6.96	183	92.00	J
000091-10-1	Phenol, 2,6-dimethoxy-	5.92	181	90.00	J
010173-80-5	Spiro[benzofuran-2(3H),2'-oxiran]-	9.39	450	72.00	J
000306-08-1	Benzeneacetic acid, 4-hydroxy-3-me	6.49	165	64.00	J
018709-51-8	Pyrazine, 2,5-bis(1,1-dimethylethy	6.92	193	64.00	J
006765-39-5	1-Heptadecene	8.53	768	64.00	J
022583-04-6	4-Methoxy-2-methyl-1-(methylthio)b	6.22	252	59.00	J

Mill Pond Outfall # 001 foam and scum


Project Area Location
Outfall 001
Reference Site
Sulphur Springs
Coffee Indian
Coffee Creek
Big Mound Ridge
Coffee Lake
Mossy Lake
SMS 002
Ouachita Up
Coffee Creek Below Mossy Lake
Ouachita Down
Clear Lake
Beech Prairie
R10W
R9W
ASHLEY
MOREHOUSE
UPPER
OUACHITA

During March of 2012 we sampled water at three locations along the wastewater stream. Chemicals chosen for analysis from the samples included phenol, arsenic, cadmium and zinc. These were common to the phenolic resin manufacturing plant and paper mill. Finding these in the wastewater discharges would establish a baseline, which if found in the ground water and city drinking water could link the plant as the source of contamination and depending on the chemicals found, could explain a sickened community. Predicting ground water, aquifer and drinking water contamination by phenol was based on previous history and experience with Georgia Pacific.

In 1974 the company had a similar phenolic resin manufacturing plant located in Tewksbury, MA. It too, was a town with cancer clusters and sickened residents. The community sought the help of the local Department of Public Health for answers. After an extensive investigation, it was determined that town drinking water wells #6 and #7, were contaminated with phenol and later benzene would also be found. The wells were located over a mile away from the GP chemical plant. Geology and hydrologic ground water flow were used to predict the potential for contamination.(4) As a result, contamination was found and the town had to abandon its wells. Drinking water was then brought in from the City of Lowell, sourced at the Merrimac River.

The damage by GP did not end with the town wells, the company also devastated many square miles of pristine animal habitat including the Great Swamp. The aerial views of the area were very similar in appearance to aerial views of devastation now in Crossett. The result was that Georgia Pacific shut down its phenolic resin manufacturing plant and moved the operation to a distant community.

A similar strategy was developed for Crossett beginning with a baseline of plant discharge water before treatment, after treatment and at Outfall 001. Results are shown in Table #1. Chain of custody was observed and chemical analysis performed by Ana-Lab Corporation in Kilgore, Texas. Chemical analysis tests included, phenol, arsenic, cadmium and zinc. Levels of all these chemicals were found, except cadmium.

We then directed our attention towards sampling of groundwater, private wells and city drinking water produced from the aquifer. All were found to be contaminated with phenol and other chemicals related to plant activities. See Tables 2,3 and 4

Top: Dead trees and vegetation Bottom: Black tarry deposits

Table 1

Plant Water Discharge 45 MGD
Waste Stream Results *Analysis mg/L*
March 3, 2012

Sample #1 before treatment

Phenol	0.0324
Arsenic	0.00463
Cadmium	<0.001
Zinc	0.592

Sample #2 after treatment

Phenol	0.0168
Arsenic	0.00369
Cadmium	<0.001
Zinc	0.570

Sample #3 Outfall 001

Phenol	0.0111
Arsenic	0.0052
Cadmium	<0.001
Zinc	0.046

In a memorandum directed to the Ouachita River Keeper, dated November, 16, 2011, Adam Babich, Director of the Tulane Environmental Law Clinic suggested that Georgia Pacific's NPDES permit is illegal because:

1) It fails to control for initial discharges to Coffee Creek, “waters of the United States” because it is a tributary to the Ouachita River, that occur in Coffee Creek above the Mill Pond and
2) It fails to require Georgia Pacific to treat its industrial wastewater in a closed treatment system.

City drinking water, is drawn from five wells in the Cockfield Formation Aquifer. The aquifer contamination demonstrates why a closed system should have been required for this operation when its capacity was upgraded in the late 1960s or during subsequent inspections and permit renewals. Test results of groundwater and drinking water show levels of hazardous industrial chemicals from manufacturing and waste water discharge. Ground water and drinking water samples were taken in July, October and December of 2012. Ground water was taken from a 45’ deep well and city drinking water from local kitchen taps. Results are shown in tables 2, 3 and 4. All samples were analyzed by Ana-Lab in Kilgore, TX. Sample and location are listed by street address.

Table 2 Groundwater Well 111 Lawson

Analysis	*mg/L*	*July 2, 2012*
Phenol	0.0523	
Arsenic	0.00935	
Cadmium	0.0941	
Zinc	146	

Tap Water 123 Lawson

Phenol	0.0218
Arsenic	0.00323
Cadmium	0.0255
Zinc	65.5

Table 3 Church Well Water 1082 Ashley

Analysis	*mg/L*	*October 23, 2012*
Phenol	0.0082	
Arsenic	Not Detectable	
Zinc	0.0645	

City Tap Water 1839 Roberts

Phenol	0.0147	mg/L
Bromoform	9.43	ug/L
Dibromochloromethane	5.61	ug/L

TABLE 4 City Tap Water 1839 Roberts

Analysis	*ug/L*	*December 11, 2012*
Benzene	0.67	
tert-Butylmethylether (MTBE)	78.9	
Acetone	5.50	
Diethyl phthalate	1.63	

Phenol

We found Phenol in the city's drinking water, ground water and the Georgia Pacific plant waste water discharges. According to the EPA, they have found it at over 500

Superfund waste sites in the USA and the chemical has been placed on the National Priorities List (NPL).

EPA records for 2010 showed Georgia Pacific's phenol usage up to 1 million pounds during that year alone. (5) Phenol is reacted with formaldehyde to make phenolic resins. Once cured, the resin becomes the plastic known as Bakelite, which was named after its discoverer Dr. Leo Bakeland in 1907. Phenolic resins are used in adhesives, coatings, printed circuit boards, foamed insulations and many other products.

Phenol is *designated as a hazardous substance* under EPA 2006b
in accordance with Section 311(b)(2)(A) 40 CFR 116.4
of the Clean Water Act. It is *also designated as a toxic chemical pollutant* by EPA 2006c
in accordance with Section 307(a)(1) of 40 CFR 401.15 of the Federal Water Pollution Control Act.

The EPA 2006 oral reference dose (RfD) for phenol in lakes and streams is 0.3 of 1 part per million, or 0.0003 ppm. The Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk level (MRL) is 1mg/Kg/day.

Phenol is corrosive to the eyes, skin and respiratory tract. Its vapors can cause edema or fluid in the lungs. Other effects include damage to the central nervous system, seizure and coma. Chronic exposure to phenol can cause paralysis, severe injury to the heart including dysrhythmia or irregular heartbeat, palpitations, tachycardia or fast heartbeat and cardiac arrest. Phenol is also known to damage the liver, kidneys and lungs.

Benzene

Benzene in Crossett's drinking water is a serious threat to human health. It is an insidious chemical found at 29% of EPA Superfund waste sites. The EPA lists benzene as a know human carcinogen.

Exposure to benzene can cause Leukemia, a cancer of the blood, bone marrow failure, and premature death. Blood disorders associated with benzene include: CML chronic myeloid leukemia, AML acute myeloid leukemia, aplastic anemia, ALL acute lymphoblastic leukemia and MDS myelodysplastic syndrome. The chemical also targets the liver, kidney, lung, heart and brain. It is known to also destroy chromosomal DNA, causing strand breaks.

Currently, EPA has set an enforceable regulation for the maximum contaminant level (MCL) of benzene at 0.005mg/L or 5 ppb. EPA's maximum contaminant limit goal for benzene is zero 0.0mg/l When benzene enters the drinking water, generally alternative sources need to be supplied. If benzene enters the environmental food chain, affected fish, animals and milk are banned from consumption.(6)

Tens of thousands of people have become ill and or have died from benzene which was found in drinking water at Camp Lejeune, North Carolina. Our military's finest and their families were exposed. Decades of debate by Congress failed to resolve the issue as more of those who were exposed died.

However, last year President Obama signed a law which will finally bring health care and screening to tens of thousands of Marines and their families who were on the base between 1957 and 1987. Health officials believe as many as 1 million people may have been exposed to the contaminated drinking water.

Acetone

We found Acetone in the drinking water. It is an industrial solvent which evaporates rapidly when exposed to air, with a sunlight UV degradation half life of 22 days. It dissipates much slower in soil and water with a lethal dose or LD50 in fish of 8.3g/L in water. Due to its excellent water solubility it is a significant threat to groundwater, contaminating aquifers and both public and private drinking water. EPA has not published a MCL for acetone.(7)

The most critical effect from chronic oral exposure to acetone is nephropathy or damage and disease of the kidney. The maximum exposure, oral reference dose, RfD is 0.9mg/

Kg/day. Acetone increase IgA antibodies in the kidney which is associated with Berger's disease, Berger's Syndrome and synpharyngitic glomerulonephritis, or inflammation of the kidney. Berger's disease or IgA nephropathy interferes with the kidney's ability to filter waste, electrolytes and excess water. It leads to blood and protein in the urine, high blood pressure, and swollen hands and feet.

Bromoform and Dibromochloromethane

Bromoform and Dibromochloromethane are toxic reaction byproducts from the use of chlorine added to water supplies or from the use of chlorine to bleach paper pulp during the Kraft paper making process used by Georgia Pacific. According to EPA TRI records for the year 2011, GP lists three records for chlorine use and storage on the property. The paper mill uses the largest quantity of between 10,000 to 99,999 pounds.(9)

Exposure to Bromoform and Dibromochloromethane can cause damage to the liver, kidneys and brain. In Arkansas they are unregulated contaminants. The Crossett Water Commission 2010 Annual Drinking Water Quality Report shows these chemicals in the drinking water. City levels were found to be 2.79 ppb and 0.53 ppb respectively. The EPA limit for both of these chemicals in water is 0.7 ppm. We found levels considerably higher.

These chemicals are also released from the water to the air through mechanical aeration, or during showering and are often noticed as a gaseous vapor when turning on a faucet. The Agency for Toxic Substances and Disease Registry (ATSDR) notes that people who drink water from a contaminated aquifer with these chemicals or who live near a toxic waste site or manufacturing facility that emit vapors are at risk.

No one should be breathing or drinking Bromoform or Dibromochloromethane. Although the EPA suggests that short term low levels of these chemicals do not cause immediate harm, long term daily exposure and intake can cause liver and kidney cancer. Damage to chromosomes, blood cells and neoplastic lesions or polyps of the colon have also been observed. There may also be an association of these trihalomethanes with bladder, colon, rectal and pancreatic cancers.

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

We did not analyze for this chemical due to the high cost of the test. However, EPA records show that GP does release it to the environment.(9) **2,3,7,8-Tetrachlorodibenzo-p-dioxin** is the most deadly dioxin on the planet. It is a byproduct of chlorine and or hypochlorite used to bleach paper pulp. Chlorine and hypochlorite react with the lignin in pulp and form a number of chlorinated pollutants such as chloroform, dioxins, and furans which are discharged in the wastewater stream. All of these contaminate groundwater and aquifers. We suggest that future testing focus on these contaminants. Many paper mills are using hydrogen peroxide as an alternative bleaching technique to avoid the production of deadly TCDD.

This chemical was involved in another disaster In Seveso Italy, in 1976. The city lies north of Milan and was the site of a terrible disaster involving its release. The local population was advised not to touch or eat locally grown fruit and vegetables. 3,300 animals were found dead and emergency slaughtering was initiated to prevent contamination of the food chain by TCDD. Over 80,000 animals had been slaughtered. The government established a plan for quarantining and decontaminating the area at a cost of 20 million dollars which tripled two years later. In 1983, the Italian Criminal Court of Monza sentenced five former employees of ICMESA to prison.

During our investigation of Crossett, we were given information of an incident that occurred in which an entire neighborhood was evacuated and did not return to their homes. Their properties were purchased and homes and possessions destroyed. We wonder if possibly TCDD was involved in the incident.

Diethyl phthalate

We found a level of 1.63 ug/L of the chemical Diethyl phthalate in city drinking water. It is an EPA class B2 probable human carcinogen.(10) It is one of many phthalates used as a plasticizer, to impart softness and flexibility to plastics. It is used in building materials, packaging, flooring, cosmetics, toys, shower curtains, raincoats, medical tubing, intravenous fluid bags and other medical equipment.

Despite phthalates many uses, they are a human health hazard and classified as endocrine disrupting chemicals (EDC). EDCs are chemicals which behave like hormones in the body interfering with the normal function of the body's endocrine system. Phthalates have been found to increase the incidence of developmental abnormalities in the male reproductive tract, skeletal malformations, decreased levels of testosterone, adverse effects on lung tissue development and reduced liver enzyme activities and more.(11)

We identified three phthalates in the drinking water samples taken in December 2012, but have only listed diethyl phthalate in our results table 4. The laboratory reported finding the two phthalates below:

Crossett Drinking Water Sample

Benzyl butyl phthalate	4.71 ug/L
Bis(2-ethylhexyl) phthalate	15.6 ug/L

However, these two phthalates were also seen as an analyte detected in the associated method blank, results shown below, so we have discarded these results. We will revisit these chemicals in future work.

Method Detection Blank

Benzyl butyl phthalate	1.25 ug/L
Bis(2-ethylhexyl) phthalate	16.4 ug/L

The phthalates found in the aquifer are consistent with the phthalates used in the manufacture of strand board and or plywood also manufactured by Georgia Pacific.

***Tertiary*-Butylmethylether (MTBE)**

We found a level of 78.9 ug/L of MTBE in city drinking water. The EPA has not set a National Standard for MTBE in drinking water. The agency states that MTBE at high doses is a probable human carcinogen and recommends exposure levels of 20 to 40 ppb or below.(12)

MTBE is used as an anti-knock additive in gasoline replacing tetra ethyl lead in 1979. Recently there has been a move to safer alternatives like ethanol. The chemical is also used extensively by industry as a safer alternative solvent in place of ethyl ether which can form explosive mixtures with oxygen in air. We suggest further investigation into the use of this chemical in manufacturing processes by Georgia Pacific, as it may be the possible source of contamination.

As a solvent, MTBE has replaced the use of the carcinogen methylene chloride, diethoxymethane and dimethoxymethane. Methylene chloride was a solvent of choice in the extraction of tall oils, lignosulfonates, and many other commercial manufacturing processes including pharmaceuticals as shown in US patents. (13) Georgia Pacific manufactures an extensive line of products from oleoresin and pine chemicals derived from black liquor including tall oil, lignosulfonates, terpenes, resins and dimer acids used in many industries.

The demand for tall oil extracts provide a ready market for some 1.9 million pounds of tall oil per produced each year in the USA. It is used to produce dimers, trimers, fatty acids, low boiling fatty acids, octadecanoic acid, rosin esters, rosin adducts and adduct salts. These derivatives are used in paper sizing, coatings, adhesives, soaps, printing inks, plastics, rubbers, oil drilling lubricants, oil additives and fuel sterols.(14)

MTBE is used as an extraction solvent for the recovery of low aliphatic carboxylic acids and is used successfully in the analysis of tall oil components, like those found in the black liquor discharged by paper mills. MTBE is mixed with black liquor under alkaline conditions for tall oil extraction and converted to trimethylsilyl derivitaves and analyzed by gas chromatography (GC).

Hydrogen Sulfide

Air sampling revealed significant quantities of hydrogen sulfide gas, a dangerous and often deadly gas emanating from the paper mill operation and enveloping neighborhoods surrounding the plant. Air contamination is often worse at night and especially during periods of thermal inversions, when what goes up into the atmosphere comes back down to the ground.

The gas we found is pervasive like a military nerve gas and enters into the homes of residents through cracks, crevices around doors, windows, through roof vents and foundations. Residents have no escape and are forced to endure daily chemical assaults. The gas numbs the sense of smell almost immediately, but does not prevent the gas from causing harm to those that breathe. The gas is also destructive of personal property, corroding air conditioners and other exposed metal.

Hydrogen sulfide can induce DNA damage by concentrations as low as 1 mmol/L. We found levels as high as 25 ppb. Levels that can cause harm. *(15)*

The hydrogen sulfide data was gathered during field sampling by Wilma Subra of the Subra Company, using a calibrated electronic portable field meter programmed for the detection of the gas. Sampling was conducted from March 6-9, 2012. Results are shown plotted on maps by Wilma Subra in this report on pages 31 to 35.

Arkansas Drinking Water Standards with EPA Detection Limits
From the Arkansas Department of Health

Primary Inorganic Contaminants (Enforceable)	MCL./mg/l)	EPA Method Detection Limit (mg/l)
Antimony	0.006	0.003
Arsenic	0.05	0.001
Asbestos	7 MFL	0.01 MFL
Barium	2	0.002
Beryllium	0.004	0.002
Cadmium	0.005	0.0001
Chromium	0.1	0.001
Copper**	1.3	0.001

Cyanide	0.2	0.005
Fluoride	4.0	1.0
Lead**	0.015	0.001
Mercury	0.002	0.0002
Nitrate (as nitrogen)	10	0.05
Nitrite (as nitrogen)	1	0.05
Combined Nitrate/ Nitrite	10	0.05
Selenium	0.05	0.002
Thallium	0.002	0.001

* MFL = Millions of Fibers (>10m m) per Liter. Analyzed by Transmission Electron Microscopy method: "Analytical Method

** No MCL. Action Level based upon 90 percentile sample results.

Organic Contaminants

Primary Organic Contaminants (Enforceable)	MCL./mg/l)	EPA Detection Limit (mg/l)**
1,1,1-Trichloroethane	0.2	0.0005
1,1,2-Trichloroethane	0.005	0.0005
1,1-Dichloroethylene	0.007	0.0005
1,2,4-Trichlorobenzene	0.07	0.0005
1,2-Dichloroethane	0.005	0.0005

1,2-Dichloropropane	0.005	0.0005
2,3,7,8-TCDD (Dioxin)	0.00000003	0.000000011
2,4,5-TP (Silvex)	0.05	0.00044
2,4-D	0.07	0.00022
Acrylamide *	TT	N/A
Alachlor	0.002	0.00044
Aldicarb	0.003	
Aldicarb Sulfoxide		
Aldicarb Sulfone		
Atrazine	0.003	0.00022
Benzene	0.005	0.0005
Carbofuran	0.04	0.00198
Carbon Tetrachloride	0.005	0.0005
Chlordane	0.002	0.00044
cis-1,2-Dichlorethylene	0.07	0.0005
Dalapon	0.2	0.0022
Di(ethylhexyl)-adipate	0.4	0.00132
Di(ethylhexyl)-phthalate	0.006	0.00132
Dibromochloropropane (DBCP)	0.0002	0.000044
Dichloromethane (Methylene Chloride)	0.005	0.0005
Dinoseb	0.007	0.00044
Diquat	0.02	0.00088
Endothall	0.1	0.0198
Endrin	0.002	0.000022
Epichlorohydrin *	TT	N/A

Ethylbenzene	0.7	0.0005
Ethylene Dibromide	0.00005	0.000022
Glyphosate	0.7	0.0132
Heptachlor	0.0004	0.000088
Heptachlor Epoxide	0.0002	0.000044
Hexachlorobenzene	0.001	0.00022
Hexachlorocyclo-pentadiene	0.05	0.00022
Lindane	0.0002	0.000044
Methoxychlor	0.04	0.00022
Monochlorobenzene (Chlorobenzene)	0.1	0.0005
o-Dichlorbenzene	0.6	0.0005
Oxyml	0.2	0.0044
PAH's (Benzo(a)pyrene)	0.0002	0.000044
PCB's (as decachlorobiphenyl) *	0.0005	0.00022
p-Dichlorobenzene	0.075	0.0005
Pentachlorophenol	0.001	0.000088
Picloram	0.5	0.00022
Simazine	0.004	0.000154
Styrene	0.1	0.0005
Tetrachloroethylene	0.005	0.0005
Toluene	1	0.0005
Total Trihalomethanes	0.100	0.0005
Toxaphene	0.003	0.0022

trans-1,2-Dichloroethylene	0.1	0.0005
Trichloroethylene	0.005	0.0005
Vinyl Chloride	0.002	0.0005
Xylenes	10	0.005

Radiochemical Contaminants

Primary Radiochemical Contaminants (Enforceable)	MCL	EPA Detect Limit
Gross Alpha (excluding radon and uranium)	15 pCi/l	3 pCi/l
Radium 226 & 228 combined	5 pCi/l	1 pCi/l
Gross Beta	4 mrem/yr*	4 pCi/l
Tritium	20,000	1,000
Strontium-90	8	2

Notes:
pCi/l = picocuries per year
mrem/yr = millirem per year

Secondary Contaminants

Secondary Contaminants (Non-Enforceable)	Recommended Limit milligrams/liter
Aluminum	0.05 - 0.2
Chloride	250
N/AColor	15 Color Units
Corrosivity	Non-corrosive
Fluoride	2.0
Foaming Agents	0.5
Iron	0.3
Manganese	0.05
Odor	3 Threshold Odor Number
pH	6.5 - 8.5
Silver	0.1
Sulfate	250
Total Dissolved Solids	500
Zinc	5

Unregulated Contaminants

Unregulated Organic Contaminants (Not-Enforceable)	MCL (mg/l)
3-Hydroxycarbofuran	N/A
Aldrin	N/A
Butachlor	N/A
Carbaryl	N/A
Dicamba	N/A
Dieldrin	N/A
Methomyl	N/A
Metolachlor	N/A
Metribuzin	N/A
Propachlor	N/A
Bromobenzene	N/A
Bromodichloromethane	N/A
Bromoform	N/A
Bromomethane	N/A
Chlorodibromethane	N/A
Chloroform	N/A
Chloroethane	N/A
Chloromethane	N/A
o-Chlorotoluene	N/A
p-Chlorotoluene	N/A
m-Dichlorobenzene	N/A
1,1-Dichloroethane	N/A
1,3-Dichloropropane	N/A
2,2-Dichloropropane	N/A

1,1-Dichloropropene	N/A
1,3-Dichloropropene	N/A
1,1,1,2-Tetrachloroethane	N/A

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